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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE
INSTITUTION OF BRITISH FOUNDRYMEN AND THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION

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Derelict Plant.

It is customary about this time of the year for the good housekeeper to turn her thoughts to spring cleaning. Similarly, conditions obtain in many foundries which render the time opportune for the putting in order of their houses.

This can admit of a wider application than the mere cleaning up, for the housewife does more than this. She clears out ornamental articles which, having become soiled and lost their value, are merely dust traps. In foundries, too, there usually exists a quantity of plant which more or less falls into a similar category. It would be well, however, before finally consigning any plant to the scrap heap to ascertain whether or not it is worth while to spend a little money on modification or repair. Then, too, there exist moulding machines which perhaps a previous foreman has tried out and found wanting. Before scrapping such machines, practically all of which are in successful operation in some foundry or other where perhaps lies derelict your favourite machine, it is desirable to give it another trial, starting with an open mind, and taking every care that the machine is thoroughly renovated and put into working order. If after this *de nouveau* trial it is still found unsatisfactory for the particular type of work handled, then it should be disposed of, where being at least clean it would fetch a better price. When asking foundrymen to approach the question of a derelict moulding machine with an open mind, we would refer them to the discussion on jar ramming machines which is given on another page of this issue, where it is clearly shown that whilst being successful in one works it is a failure in another.

We tentatively put forward that it occasionally happens that a foundryman is supplied with a machine which is beyond his ken, and it is not the machine which is at fault, but lack of knowledge on the foundryman's part.

It has been asserted that a specialist engaged upon the work of introducing an improved or novel machine can say definitely before the plant has been in operation a week as to whether it will be a success or failure, by the interest, intelligence and attitude displayed by the staff detailed for its operation. Cases which sometimes reach the Courts of Justice clearly show that old-fashioned works have bought modern plant, but they are so little modernised in their technical knowledge that the plant, no matter how good or efficient, could never become a successful producing unit until these works have assimilated the necessary technical knowledge and common sense.

It is of such machines to which we refer when we ask that they should be given a fresh trial, for if there is only one similar machine which is making good then, conditions being at all equal, there is no reason why all the sister machines should not also become profit-making appliances.

The Foundry Exhibition.

In one of the largest foundries in the East End of London many of the moulders, patternmakers and other employés are paying into a special fund created for the purpose of enabling them to visit the exhibition when the time arrives, without having to draw upon savings or other funds. The honorary secretary of the London Branch, whose address is given in the adjoining column, asks us to state that he will be pleased to hear of any other foundry or works which would be willing to inaugurate similar schemes. By such means he hopes that the movement could be co-ordinated, and perhaps cheaper and better railway facilities afforded.

We are of opinion that other foundry centres located at some distance from Birmingham would do well to follow London's lead.

A little foresight such as has been shown by London will go far towards making the exhibition a success, as it will help in a large measure to show to the foundry employé the wide possibilities of their craft. This would obviously make for foundry progress.

National Federation of Iron and Steel Manufacturers.—This Federation's Statistical Bulletin is now available to the general public at a subscription rate of 14s. per annum, post free. The Federation's address is Caxton House (East), Westminster, S.W.1.

Midland Railway Carriage and Wagon Works at Derby.

Through the courtesy of the Editor of "The Railway Engineer," we are able to give a description of the Midland Railway Company's foundries at Derby.

Fig. 1.—View of Main Bay of Foundry; Midland Railway Works, Derby.

The Iron Foundry.

The iron foundry, illustrated in Fig. 1, has a floor space of 520 ft. by 43 ft., with a fettling shop measuring 100 ft. by 43 ft., and a core shop, 36 ft. by 43 ft. The main bay is served by a 5-ton overhead electric crane, and the output of carriage and wagon castings is 150 tons in a normal working week of 47 hours. In addition to this, a variety of castings is made for the signal department.

The core shop has five core drying stoves, 11 ft. by 10 ft. by 7 ft. high, these being heated by means of coal gas, and in addition two smaller self-contained stoves are used for drying cores for emergency work. The core box for oil axleboxes is rather interesting, and a photograph showing it (Fig. 2) is reproduced herewith. It consists of a core box made in halves which are capable of sliding on the bar seen in the illustration. The operator can be seen ramming up, and after this is done the box is turned over; then by means of a small lift the weight of the core is taken and the box divided, leaving the core on the core-plate. One half of the core-box removed from the bar can be seen on the bench.

Fig. 2.—Core Box for Axleboxes; Midland Railway Works, Derby.

Most of the work in the foundry is repetition work, and advantage has been taken of this fact to put practically all patterns on plates.

Stripping plates are used very extensively, and the extra expense of these is undoubtedly justified by the reduction in faulty moulds and the consequent loss of time in patching.

The small Pridmore machine, illustrated in Fig. 3, is used on all classes of small work, and takes a 12-in. square box. Oil axleboxes are made

on the "Britannia" jar ram machines. These are arranged in pairs, one at each end of a line of rails, on which the boxes are placed for casting. One machine makes the top, and the other the bottom part of the box. One of these machines is illustrated in Fig. 4.

Fig. 3.—Brass Foundry, showing Pridmore Machines set up for Making Brasses. Midland Railway Works, Derby.

The moulding machines are so arranged that the man operates the air-control valve by means of his foot, leaving his hands free; a small point, perhaps, but one tending to increase the output. In order to make the work as easy as possible, air hoists have been installed for lifting off the boxes.

A similar lay-out of jar ram machines is used for making buffer castings, two in a box, and the normal output from these machines is about 50 to 60 complete moulds per day.

There have recently been installed two "Ajax" turn-over jar-moulding machines, which are being used on heavier classes of work. The iron is melted in two drop bottom cupolas, each having a capacity of 4 tons of metal per hour, and these are used on alternate days. The blast is supplied by means of a Root's blower, and the pig, scrap, and coke are taken up to the charging platform in a wagon by means of a hydraulic hoist.

In the fettling shop the benches are arranged so that at the ends of them the castings are discharged through the wall of the shop into trailers standing outside, the arrangement being illustrated in Fig. 5. The scheme commended itself to the works' authorities at Derby as one which would expedite the work, and also save the fettlers much handling of heavy castings.

The arrangement of the benches is seen in Fig. 6, and it will be noticed that in the centre of the bench proper a number of rollers are inserted, these being about 12 in. long by 3 in. diam., which enable the fettler to push his castings along to the discharging point without having to lift them.

On a 12-ton coal wagon there are 10 cwt. of cast-iron parts, therefore 200 wagons per week necessitate 100 tons of castings; in addition, an output of ½-cwt. of brasses is required per wagon.

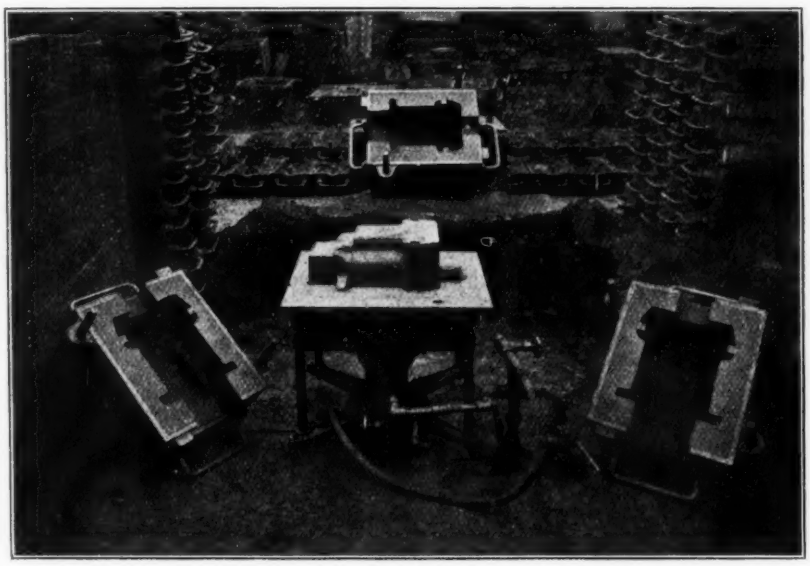

Fig. 4.—Britannia Machine, showing Axlebox Patterns in Position, and Moulds at the Side; Midland Railway Works, Derby.

XUM

The Brass Foundry.

This building has a floor space of 150 ft. by 100 ft., the height to underside of principals being 21 ft., and ventilating fans are fixed in the roof. All new Midland stock, both passenger and goods, runs on white metalled bearings, in oil axleboxes, and the lining of the brasses is done in this shop.

Fig. 5.—The Discharging End of the Fettling Benches; Midland Railway Works, Derby.

The furnaces for melting the white metal are gas heated; and the brasses and chills are also heated on gas burners.

The bearing brasses are made on Pridmore moulding machines, fitted with stripping plates. With these machines a youth is capable of laying down 15 boxes, equal to 30 castings per hour. Originally these brasses were made in large box parts, each part measuring 20 in. by 18 in. by 4 in., and weighing 1½ cwt.; by cutting down the number of brasses made in one box, and reducing the size of box parts, the work has been made very much lighter (each part weighing 45 lbs. after ramming), and the output has been considerably increased. Melting is done in 600-lb. Wright tilting furnaces, gas-fired, the blast being supplied from a Bryan-Donkin blower, giving a pressure of 3½ lb per sq. in. The gates are cut off the castings by means of a Roberts git cutter and a motor-driven grinder is used for fettling purposes. The bearing brasses form the bulk of the brass foundry output, but practically all the brass furniture for Midland carriages is made in the foundry, as well as large quantities of bearings and other fittings required for millwrighting purposes.

Fig. 6.—Fettling Shop, showing Arrangement of Benches; Midland Railway Works, Derby.

The Whitehead Iron & Steel Company, Limited, recently started up the new mill at their Newport (Mon.) Works. The company were pioneers of the continuous mill in this country, and it is interesting to note that the new plant was started up on the 14th anniversary of the starting up of their first installation, the 10-in. continuous bar mill, which was put into operation on February 14, 1908, at the Deighton Iron & Steel Works, Tredegar. The continuous combined strip and hoop mill which has just been started at Newport will be fully described in our columns at an early date. Meantime it may be noted that the mill is the first of its type to be built.

The Early History of Iron with Special Reference to Cast-Iron.

By J. Newton Friend, D.Sc., Ph.D., F.I.C. (Carnegie Gold Medallist).

(*Continued from page* 183.)

Iron in Britain.

For many years, probably several centuries, before the invasion of the Romans in B.C. 55, the Britons were familiar with iron. Their chariot wheels had iron rims, as is proved by remains found in Yorkshire, although it is very doubtful if they were fitted with scythes for laming hostile infantry,* as history books used to tell us, and as Boadicea's chariot is depicted as having in the statuary on the Thames Embankment at Westminster Bridge. Cæsar, however, mentioned that the Britons were accustomed to use bars of iron in place of coins as currency, and several hundred of these, which have escaped more or less the ravages of time, have been found and lodged in different museums, notably the British Museum and in the museum at Worcester.

The bars resemble swords, and consist of a flat and slightly tapering blade with blunt vertical edges. A rude handle is formed by turning up the edges so as to meet one another at a point some 2 ins. from one end.

It is only quite recently that the true nature of these currency bars has been discovered, the credit being due to Mr. Reginald A. Smith, of the British Museum. The bars resemble swords so closely that they were formerly regarded as unfinished ones or as some kind of tool.† It is not at all impossible that other currency bars are lying unrecognised in museums and in private collections, and catalogued under other names.

The improbability of these bars ever having been swords in a more or less half-finished state is summarised by Smith as follows:—

1. The bars have frequently been found in considerable numbers hidden away as if constituting a hoard, much in the same way as coins have been usual hidden. They have been found also right in the centre of British camps. This was the case, for example, at Meon Hill, Gloucestershire, where in 1824 some 394 bars were discovered in a heap.

Now it seems much more probable that the ancient Britons would conceal their money at a crisis, rather than that they would stop to bury half-made swords.

2. Division of labour is a mark of civilisation, and in early British days such division was by no means in an advanced stage of development. In other words, the armourer who shaped these bars would himself produce the finished swords, if indeed swords they were to be. It is not probable that he would prepare a large number to hand on to another for the finishing process.

3. The bars vary considerably in size and weight, some bars being as much as 16 times as heavy as others. Thus only a small fraction of them could ever contain the right amount of metal to yield a sword of the period.

4. The most conclusive evidence, however, that the bars were never intended as swords lies in the interesting observation that the weights of all the heavier ones must originally have been simple multiples of the weights of the smallest ones.

Owing to the corrodibility of the iron, all the bars yet found have suffered some loss in weight. Fortunately, however, there are a good many which have been only relatively slightly oxidised, and it is possible to estimate roughly what their original weight must have been. When this is done, it is found that the weights approximated to 309 grams. (4,770 grains), or to some multiple or sub-multiple of this amount. In all, no fewer than six different denominations have been found, of the following presumed standard weights:—

	AVOIRDUPOIS		
	Grams	Grains	Ounces
Quarter	77	1,193	2¾
Half	154.5	2,385	5½
UNIT	309	4,770	11
One and a half	463.5	7,155	16½
Double	618	9,540	22
Quadruple	1,236	19,080	44

The reason for choosing the third denomination, namely, 4,770 grains, as the unit, lies in the fact that in the Cardiff Museum is a bronze weight which was found in association with enamelled bronze ornaments of Late Celtic character near Neath, in Glamorganshire. On the top of this weight is engraved, the figure I., and it weighs 4,770 grains. A similar weight, but in basalt, lies, or rather did lie before the outbreak of the Great European War in 1914, in the Mainz Museum. It bears the mark I., and weighs 4,767 grains, that is, the same as the preceding within the primitive range of measurement. These weights represent half an attic commercial mina of the period prior to B.C. 160, and show that even at this early date Britain recognised the same standard weights as the Continent.

It is highly improbable that the early British would have six different sizes of swords; still less is it conceivable that the smith would go to the trouble of carefully standardising the weights of his swords when they were still in an unfinished condition.

The evidence clearly points to the supposition that these bars are indeed the currency bars referred to by Cæsar as used by the early Britons at the time of his invasion. The use of currency bars or blades may be traced back to the early Greeks, and survives to-day in some parts of Africa. As we have seen, in the Homeric period iron was used for barter. Dechelette, who was, most unfortuntely for antiquarian research, killed at the front in the early years of the Great European War, traced the currency bars back to the spits for roasting flesh. It is said that Pheidon deposited in the Heræum certain iron bars that had till his time, namely, prior to B.C. 600, done duty as money. Waldstein, during his excavations of the Heræum some years ago, discovered a bundle of iron rods which quite possibly constitute the remains of Pheidon's gift.

Iron in Central Africa.

Schweinfurth, who travelled widely in Central Africa, states that the only equivalent for money possessed by the natives in that region is that of the Bongo tribe, and is known as the "loggoh kulduttv." This is an iron spade-like article formed in flat discs from 10 to 12 ins. in diameter. On one edge is a short handle,whilst on the diametrically opposite edge is a projecting limb something like an anchor. It is in this form that iron is stored amongst the treasures of the wealthy, and serves in place of money for commercial exchange and for marriage portions. In Cambodia, Indo-China, iron ingots are used as a special kind of money or currency. They are not weighed, but are as long as from the base of the thumb to the tip of the forefinger; they are two fingers in breadth, and one finger thick in the middle tapering off to either end.

We are inclined to smile at these crude methods of measurement, but let us not forget that three barley corns were at one time taken to measure an inch, and the heights of horses are still measured in "hands," a term reminiscent of the time when the span of the average human hand was regarded as a sufficiently accurate standard of measurement.

When the Cape of Good Hope was first colonised the Hottentots employed bars of iron and cattle in place of currency. On the west coast of Africa the *bar* is the unit of currency, and all merchandise is reckoned by the *bar*, which has a definite monetary value to-day, although originally it referred to the exchange value of a bar of iron of fixed dimensions, with which early European traders transacted business with the natives.

* See R. A. Smith, *A Guide to Antiquities of the Early Iron Age*, British Museum.

† R. A. Smith, *Proc. Soc. Antiq.*, 1915, 27; 69. See also 1905, 20; 179. 1907, 21; 319.

From the foregoing it is evident that the idea of using iron bars as currency dates back to very early times, and has been adopted by primitive peoples down to the present time. It must be confessed, however, that it is difficult to understand how the idea of using currency bars reached this country, since none of the peoples between Britain and Greece appear to have adopted the system. Possibly this is but another example of two peoples each independently hitting upon the same idea.

Two British currency bars were examined by Prof. Gowland, who reports that one (bar B) was similar in structure to iron produced by primitive methods, such, for example, as those adopted in the heart of Africa by the natives at the present time. The other (bar A) resembled, both in analysis (it contained nickel) and in structure, as revealed by the microscope, meteoric iron. This is an observation of particular interest.

The analyses were as follows:—

	Bar A.	Bar B.
Carbon	trace	0.08
Silicon	0.09	0.02
Phosphorus	0.69	0.35
Manganese	nil	nil
Nickel	0.23	nil

It thus seems fairly certain that the British were familiar with iron in the second century B.C., and very probably at an even earlier date. It is difficult to say when bar currency became obsolete in these islands, because different districts varied enormously in their relative states of civilisation. For example, an early writer states that even three centuries after Cæsar's first visit there were Britons living in outlying marshy districts, possibly the Cambridgeshire Fens, who "encircled their loins and necks with iron, deeming it an ornament and evidence of opulence, in like manner as other barbarians esteem gold."

Possibly Christ had treasure of this kind in His mind when He enjointed His followers not to lay up stores on earth "where moth and *rust* doth corrupt" (Matthew vi, 19). But the same idea of corrosion occurs in connection with the more valuable metals, namely, silver and gold, in James v, 3, so that we cannot be certain either way. It is interesting to note, by the way, that the Greek words translated *rust* in the above passages are not the same in the two cases.

Direct Reduction of Iron Ores.

All the primitive methods of reducing iron from its ore were "direct" methods, no attempt being made to obtain cast iron, which was economically unknown. Until mediæval times the furnaces were too low, and the blast too feeble to yield cast iron in normal work, although in exceptional circumstances it is possible that cast iron was occasionally produced in small quantity. Such a supposition would account for the remarkable statements of Pliny, to which attention has already been directed. Its brittleness, however, would render forging impossible, and its high melting point would prevent its utilisation for castings. The probability therefore is that it would be recharged into the furnace in subsequent runs.

There are several ways by which information has been obtained as to the manner in which primitive man reduced his ores. Two of the most important direct methods consist in studying the remains of ancient furnaces and in comparing these with inscriptions or documents also of ancient date. Another consists in learning how uncivilised races at the present time extract their iron from its ores in such regions as have not as yet been influenced by modern civilisation. Gowland mentions that the type of furnace still surviving (*i.e.*, in 1912) in India among the hill tribes of the Ghats is closely analogous to the prehistoric furnaces of the upper basin of the Danube and of the Jura district in Europe.

(To be continued.)

The partnership heretofore subsisting between Messrs. T. E. Forster, D. Greig and T. Gee, carrying on business as acetylene electrical welders and millwrights, Sunnyside Works, Tanyard Brow, Hyde Road, Gorton, Manchester, under the style of the Gorton Welding & Engineering Company, has been dissolved.

A New Position.

By J. Drinkwater.

Promotion for the foundryman has meant in the past being appointed as a foreman or foundry manager. This fostered the belief that pattern-shops are cul-de-sacs, and do not open up the same avenues to ambitious men as do the drawing office and even the fitting shop. Whether the belief, prevalent and widespread as it has been, is justified may be disputed, but a new career is now open to the trained foundryman of conspicuous ability, although, as far as the writer knows, no definite and distinctive title has been attached to the new position.

Most foundrymen, which term should include both pattern-makers and moulders, have had experience of the loss of time and annoyance caused by alterations having to be effected after a job has practically been finished. What may appear as a very simple alteration when viewed on the drawing may actually involve a great deal of labour and, as in the case of pattern-making, of spoilt timber. Many alterations of this kind could be avoided or very considerably reduced if it was someone's business to look for practical difficulties. In many shops the pattern is nearly completed before the draughtsman has an opportunity to inspect it, and this is not always an easy matter for him because patterns are not usually models of the required castings. Thus objectionable details of design may not be noticed until the casting is on the marking-off table when nothing can be done. Again the pattern-shop and the foundry may be at some distance from each other which renders close collaboration extremely difficult. The consequence of this is that the moulder has frequently to contend with difficulties that could have been very easily obviated by a mutual understanding. Some firms have appreciated the saving that might be effected in this way, and have appointed a man who acts as a go-between among the various departments smoothing out difficulties and giving helpful advice and expert technical advice. The best-suited man for such a position is undoubtedly the practical foundryman; no other can appreciate the difficulties of pattern construction and moulding of even a comparatively simple piece of work. The foundryman occupies the middle position between the drawing office and the erecting shop, and in order to do his work must have a knowledge of every operation from the time the drawing leaves the drawing office until the finished machine or engine leaves the works. Thus he has to consider, or the patternmaker at least has to consider it, whether it will be possible to machine all parts marked for machining, and if so, how they will be machined. Valuable suggestions are also frequently made by the foundryman to the draughtsman which result in a much more satisfactory casting. Chaplets, for instance, are always a necessary evil to which engineers have always a rooted objection. Provision is not always made on the drawing, however, for supporting cores. The foundryman suggests one or two small cored bosses at suitable places to support the main core, and which can easily be plugged afterwards and the result is a much stronger casting than if chaplets had been used. Many other cases might be cited where the foundryman's knowledge is of assistance to the draughtsman.

It is very nearly certain that most firms of any size will in the future appoint a man to advise on methods and to act as prompter to the various foremen and whose chief authority will be a sound knowledge of engineering and foundrywork combined with natural attributes even more valuable. Such a position is not an easy one to fill, but it opens up a fair prospect for the right type of man. As an important factor in inducing efficiency and economy this new career of production foundryman—to coin a phrase—cannot be over-estimated. A great deal that the foundryman is blamed for at the present time should be attributed to other departments, and anything that will tend to improve the quality of castings and also reduce production costs is good for the industry. It may be that this innovation will tend to stimulate ambition among young foundrymen. There is a dearth of really suitable men for such a unique career, and it will be deplorable if these positions are secured by men who have not the specialised knowledge that the foundryman possesses.

Institution of British Foundrymen.

EAST MIDLANDS BRANCH.
ANNUAL DINNER.

The second annual dinner was held on March 4 at Derby. The chair was taken by Mr. W. T. Evans (Branch-President), supported by a representative company including the Mayor of Derby (Mr. W. R. Raynes), Mr. John de Looze (President, Derby and District Engineering Trades Employers' Association), Mr. Oliver Stubbs (President of the Institution), Mr. F. W. Shurlock (Principal, Derby Technical College), Mr. H. L. Reason (Vice-President of the Institution), Mr. T. Vickers (British Cast Iron Research Association), Mr. S. H. Russell, and Mr. H. Bunting (Hon. Sec.).

The loyal toast was given from the chair, and the speech-making was interspersed by a fine programme of musical items contributed to by Madame Irene Buckley, Mr. Arthur Bond, and Mr. Warren Jones.

Apologies for absence were received from Mr. H. H. Moore, of Loughborough, Past Branch-President, and Mr. H. Pemberton, one of the founders of the branch, both of whom are ill.

Economics for Foundrymen.

MR. JOHN DE LOOZE (President of the Derby and District Engineering Trades Employers' Association) proposed the toast of "The Institution of British Foundrymen," and said he supposed they were out to prevent wasters, for they were a body which met in mutual discussion to find the best means of turning out castings. They were making progress, having started 18 years ago with 98 members and had increased to 1,800, and now had the distinction of being established under Royal Charter. He was sorry there were so few members in Derby, and would urge on all the members of the trade the need for joining. There was one problem which they as an Institution might very well approach from the educative side, some of the economic problems such as how to sell the goods when they were made. They might get lectures on the economics and the meaning of the differences of exchange. We must be able to produce cheaply in order to exchange our commodities.

The Engineering Crisis.

In response, MR. STUBBS said we were to-day passing through a crisis not only in engineering but in the world, when level speaking and level thinking will be required, and said it was no use trifling with facts. He had been in very close touch with labour and employers during the last few weeks, and he was proud to say that the time has arrived when as a nation we have got to decide whether we are going to carry on on economic and British lines as in the past.

They had an Institution of which they could rightly be proud, and if there were more institutions on similar lines we should have very much less to worry about so far as labour troubles were concerned. He had every sympathy with the workers. He was not one of those who believed that the reduction of wages is the solution of our difficulties. The solution of our difficulties is how to produce at such a price to enable us to sell our commodities. He did not care what wages were paid or what profits employers took; the great point was that both sides must work together—and they could only pay out of what they produced—it was an economic basis. If the Institution was doing nothing else it was bringing together the two sides, and enabled them to exchange on a friendly basis their opinions as to methods in the foundry and thus enable us to retain that position which Great Britain has had in the past—the first position. It was up to us as employers and as employés to put forward every effort to keep that position. There was no doubt that in a great many ways our friends across the water are moving every effort to get in front of us, but he did not think to-day there was a finer man than the British workman. He had the utmost admiration for him, and in a very great number of cases they as employers had not treated him as well as they might. A person who was comfortably situated was not always able to judge of the position of the other man. There were men who could not attend all meetings, and it was for employers to help their workers in this direction. They needed propaganda work so that those who were making every effort to spread unrest would have a very hard battle to fight if the employers on their side did their share. During his term of office he had covered 15,000 miles in visiting branches, and had formed many of the dearest friendships in his life. They had got the Government to form the Cast Iron Research Association, and if employers would give it the support it deserved it would do a tremendous amount of good. Sir Oliver Lodge had said that we were an unscientific nation trying to live in a scientific world. We had not perhaps advanced on the scientific side so much as we might have done, but with such an Institution they had an opportunity of placing the iron-foundry trade in the position which it should occupy and yet had never occupied in the past.

Scientific Study Necessary to Increased Trade.

MR. F. W. SHURLOCK, Principal of the Derby Technical College, proposed "The East Midlands Branch," and referred with pride to the fact that their Secretary (Mr. Bunting) was an old student of the College. Their industry was one which was vital to the prosperity of the country, an industry which exhibits the application of the most interesting scientific principles of chemistry and physics, and yet the President of the Institution had referred to theirs as the Cinderella of the industry. He supposed in the lower branches the work was rather dirty, and perhaps uninteresting. If it were uninteresting that was because it was not properly understood, and the remedy for lack of interest was education in the scientific principles which underlie the industry, for once understood this work would become interesting, and they would not mind the dirt. He understood there were great difficulties in getting moulders and boys to come into the trade, and when in to gain technical education. Their President had mentioned the difficulty of selling their goods when they were made. He could not give them any easy recipe for doing that, but he was very certain they would not do it unless they made a scientific study of their industry.

Help from Employers Needed.

MR. EVANS, in his reply, spoke of the wide area covered by the branch, and said members had to travel in cases 30 miles to attend meetings. He believed there was a great deal of scientific knowledge in the country, but the trouble was to apply it to industry. The Institution had brought employer and employed together, and they could now go into the foundry and argue the scientific side with the men. Their idea was to get all thoroughly interested, not merely from a bread-and-butter standpoint, but also from the pleasure in work, in producing something worthy. They must get the foundry clean and hygienically arranged, and then if they got the people interested in the scientific way they would have achieved one part of their object. Employers should help their workpeople to attend the lectures, and they would find it paid them in many ways.

Technical Associations make for Efficiency.

MR. H. L. REASON, Vice-President of the Institution of British Foundrymen, proposed the toast of "Kindred Associations," and said how very much they in the Birmingham district appreciated the way members of the East Midland Branch had supported the Convention. It was a pleasure to propose the toast because all the great societies formed in connection with engineering work of the country have one object in view—all their members striving to improve their knowledge in order to make themselves more efficient individually and collectively. Unlike most organisations, we have no rivalries or jealousies, but we all work with one object in view, to lift the standard of production to its highest level.

The great outstanding feature in connection with any of the societies is the wholeheartedness of the members to assist each other on every occasion.

Having won the war, it is now up to us to win the peace, and like many others, he felt with the research work done during the war, and the determination shown on all sides to make the most use of these developments after the war, success was bound to come.

XUM

The Power of Technical Societies.

The Secretary of the Cast Iron Research Association, Mr. T. Vickers, responded, and referred to the power and influence which was latent in the large number of societies, and he thought that if employers would but grasp the value to their business in allowing workers to join such associations they would arrive at the conclusion it was worth while to pay the subscription for them. There was a direction in which they could do more; a technical society should take on further civic responsibility. The membership was supposed to be composed of men with practical knowledge, and he held that no local authority should attempt to carry out any public proposition which entailed scientific information without consulting the local technical society. It was a remarkable thing and, to his mind, a disgrace to the technical institutions of this country, that they had not taken into consideration holding of foundry classes, for in the whole of Great Britain there were only 21 institutions which conducted classes for foundry training.

He thought it was a very great pity that the Labour Party did not take more interest in our technical institutions. He said that if the Labour Party had adopted a more creative policy and attended the discussions of technical societies they would adopt a policy which would lead to greater human progress.

Technical Societies and Research Associations.

The technical societies were using their power and influence naturally. During the war it was found there were very few manufacturers in the country who were not behind in their methods of production, speaking scientifically. They found Germany had so organised her industries on scientific lines that her methods of production were such that they competed with us in price and quality, and America was following her closely; and it was not until 1915 that our technical societies forced the hands of the Government to bring into force a scheme for the co-operation of science with industry—and the Institute of Metals and British Foundrymen, to whom they owed a great debt of gratitude, had brought into being two research organisations. If the manufacturers would not help to keep up our industries, someone else would have to use a prod. It was a remarkable fact that although cast-iron is a product which affects every industry, and could not possibly be done without, yet its methods of production are the most ancient of all, and it was even more remarkable that in all the engineering trades where cast-iron is used more than any other metal there has been less development in that metal than in any other commodity used in engineering work. That is a serious state of affairs. The time had arrived now when, if we were to keep the industry alive, something on the lines which his Association was trying to do, would have to be carried out by everybody.

Mr. S. H. Russell (Leicester) proposed "The Visitors," and regretted the illness of Mr. H. Pemberton, which prevented him from giving the toast. He maintained that the foundry work was interesting, especially when a casting exploded.

In reply, the Mayor of Derby said he had heard some derogatory remarks that evening about their industry. It was said to be a dirty trade, but nothing was dirty which brought in an honest living. The sweetest music was turned out by the foundryman in the form of bells. He had seen that triumph of engineering—the Forth Bridge. Then during the war they were called to produce the necessary articles for the terrible industry of war. They must then realise how absolutely essential they were, and an industry of which they might well be proud; and he was proud, too, that their Institution was representative of all sections of its workers, who are out to make the industry what it should be. He was sorry to hear that in England to-day we were still working in the foundry industry in methods which were antiquated, and had been discarded 25 years ago in other countries. That would not do. The call had come that we must bring every effort to bear, all our knowledge and science, use every means to increase that knowledge and science for the perfecting of all industry in order to make ourselves once again the paramount industrial nation of the world. All must consider it their first duty to put Britain first and foremost among the manufacturing nations of the world.

LANCASHIRE BRANCH.

JAR RAM MOULDING MACHINES.

At a meeting held on December 3, Mr. W. H. Meadowcroft (Branch President) in the chair, a discussion upon jar jam moulding machines was opened by Mr. J. Hogg (Burnley). He said it had been his opinion that machines of this type were making rapid progress, and it was curious that, although application had been made to many persons interested in their production, no one was willing to read a Paper on the subject before the Branch. The most that could be got was a promise to do something in that way in the future. He therefore proposed to give an account of his own experience, and he would ask the members to do the same, and to give a reply to the question whether jar ram moulding machines were suitable for both light and heavy work.

Poor Results Obtained.

A few years before the war the management at the foundry where he was foreman decided to improve the methods used in quite a number of jobs. At the time they had four pneumatic presser-head machines for small boxes, about 16 ft. × 12 in. × 4 in., and they were turning out 3,000 castings per day. Other jobs were not wanted so rapidly, but were turned out in lots of 50 and 100. It was impossible to keep up delivery, and orders had to be sent out, sometimes to a distance. Therefore a change had to be made. They had no plates cast or mounted, so they started at rock bottom. The management desired to discover the machine most suitable for an all-round class of work, and the jar ram machine was recommended. The first trial was made with a straight-draw machine, which lifted up the box from the pattern-face side-down. They mounted the pattern plate on the top of the flat surface of the table and rammed it up with a jar method, pressing a lever and giving it three or four bumps. The box was lifted up by means of little pillars away from the pattern, and then lifted off and put down on the floor. Stop valve and sluice valve castings were successfully made with that machine, which was simply and easily worked, and at first pleased him very much. For the making of small pillars in lots of 100, the machine produced fair bottoms. Another job—a 24-in. sq. grid or grate, strengthened by two fish-backs being cast on it—gave a very mixed experience. All the facing sand used for making the top was ground. Sometimes wonderful results would be given, followed by batches without a single good one amongst them. The employment of a man who was considered to be an expert did not alter matters. Very reluctantly the machine was sent back. It was naturally assumed that the difficulty with the grid top could be overcome by using a turnover-table machine, and one was installed. It drew the pattern away from the mould, face-side up. Not a single good result was forthcoming, and no matter what sand was used the core came up with the pattern every time. Finally the jar ram was given up.

Even where it was successful it had to be carefully considered whether the jar ram was quicker than hand ramming. The machine was stationary and the boxes had to be carried a certain distance. Each day the sand had to be carried back again to the machine and filled in the boxes, which occupied some little time. A large percentage of bad draws was another important item. In hand ramming a bad mould was rarely encountered, and the boxes could be left when they were turned over on the floor, and the sand was also at hand. The same thing applied to steps for staircases, which were 2 ft. long by 10 in. broad. Difficulty was never experienced in making those castings. On the other hand valve castings were made quicker and slightly better by the jar ram.

Vibration Troubles.

A point which had to be borne in mind was the shaking of the floor during the jarring. A bed of concrete 3 ft. 6 in. deep did not entirely prevent the shaking. At that time a number of tank plates, which carried no gaggers in the top parts, were being hurried along. The shaking of the floor so impressed him that he moved the job away to another foundry. The machine certainly turned out some beautiful moulds, but for jobs with lugs or similar contrivances on the side, trouble re-

sulted from soft places underneath. This was overcome by jarring half-way up, and by horizontally imposing a rammer handle, and then filling again to the top. Even when it was charged up twice the mould came out with the plate thicker than it should be.

He was greatly impressed by the possibilities of the jar ram machine, but hand-ramming with the ordinary turn-over table, with which an intelligent man could get a good production on all classes of intricate castings, constituted more than ordinary competition. One advantage of hand ramming was that the ramming could be regulated. Certain jobs must be rammed very lightly and quickly; others, such as valves, required ramming more tightly.

Good Results Realised.

MR. CLARKE said during the last three years, there had been put in at the foundry of the National Gas Engine Company at Ashton-under-Lyne, six jolt-ram machines. Five of these were by Macdonald, of Glasgow; the other was a Britannia machine, which was used for making cores. There were two No. 9's worked by plate moulders, which produced such castings as pipe bends, T pipes, sole plates, outer pedestals, base plates and standards for petrol engines. One job was the exhaust box of a gas engine, which was from 14 in. to 15 in. diameter, and had a flange at the bottom joined by a core. The castings made on those two machines varied in weight from ¼ cwt. to 5 or 6 cwt., and all were cast in green sand. The plate was of steel 3 ft. 6 in. sq., ¾ in. thick. There were several holes drilled in the plate so that any kind of pattern could be put on. They were very successful indeed as regarded plate moulding; some boxes were made in aluminium, and varied in size, the largest being 3 ft. 4 in. sq. by 15 in. deep.

On a No. 12 machine heavier castings such as liners and cylinders were made, the weight varying from 6 cwt. to 15 cwt., and the dimensions about 3 ft. 6 in. diameter and 4 to 5 ft. long. They were mostly dry-sand moulds. On this machine gas engine beds were cast in green sand with good results. The boxes varied from 5 ft. 3 in. × 2 ft. × 16 in. to 4 ft. × 2 ft. 9 in. × 2 ft.

A No. 16 machine had a plate 8 ft. long by 6 ft. wide, and the castings weighed up to 30 cwt. Whilst flywheels were unsuited to this machine, such castings as boiler shell casing, scrubbers, and other descriptions of gas plant came out very well. The boxes were 8 ft. × 3 ft. 6 in. × 21 in., also 5 ft. sq. × 2 ft. and 4 ft. 6 in. sq. × 2 ft. Floor plates had been made on this machine. They were 3 ft. 6 in. × 2 ft. 6 in. × 1¼in., thick ribbed, and were cast green, the results being quite good. Those four machines were working constantly at the present time; there were three plate-moulders on the two No. 9's, a moulder, a labourer and an apprentice on the Nos. 12 and 16. In ramming, both with green sand and with dry sand, the machines had given satisfaction, and judging from their performance he had no hesitation in saying that both light and heavy castings could be made. They could ram the moulds like stone, and there would be no fault to find with the castings. A few weeks ago he observed a moulder jolt a machine 102 times, and the next morning he ascertained that the castings were quite sound, without a sign of scabbing. Trouble sometimes arose, however. For instance, in the making gas engine beds it was found that the moulding machine was not altogether an advantage from the comparative cost aspect, in spite of a run of 80 castings without a failure. No trouble due to the vibration spoiling moulds had been experienced by the speaker.

Squeezer Machine more Rapid for Pillars.

MR. A. L. KEY said some years ago he had a 2 ft. sq. table machine, and flattered himself that he did some very good things with it. Some flat work could be made successfully with the jar ram, but in making a comparison with the ordinary squeezing machine on a particular job, he found that two girls, working under the same conditions, and apparently as hard, turned out twice as much work with the squeezer as they did with a jolt rammer with lifting pillars, similar to the one Mr. Hogg had mentioned. In that shop they made firebars 5 in. deep and about 3 ft. 6 in. long. There were four bars in three slots. They were given to an experienced workman, but the results were very bad. He therefore put loose patterns on a board, put them on the jolt ramming machine, put a sprig in them, and allowed a labourer to operate the machine, with the result that less than 5 per cent. were wasters. In the matter of time there was no comparison. The labourer would jolt one in less time than a man would bed a pattern on the floor.

Venting Unnecessary.

A fundamental point was the temper of the sand. If the moisture was in excess it was against the principle of jar ramming, and the sand flaked and came away in cakes. He could make a flywheel on the jar-ramming machine in less than half the time that any man could make it on the floor, using a loose pattern. The best subjects were exhaust boxes, pipes and similar castings, where the sand could flow freely; when there were lugs or projections it was a different proposition, because the sand was falling away, and the only successful way was to block up the pattern. From experience he did not advocate the jar-ramming machine for light, flat work. For such work it did not compare with a good plate-moulder or a good power-squeeze machine for speed. The jar-ram machine would certainly successfully ram up a heavy job. A redeeming feature was that no venting need be used; yet no matter how hard it was rammed up bad results never came about, because it was self-venting.

More Poor Results.

MR. A. HILL said his experience was with two machines, which had a 2 ft. sq. table. The first trial was with boxes about 17 in. × 12 in. × 3½ in. If they made eight boxes per day it was as much as they could get. When turned on the floor they dropped out of the bottom. To overcome the difficulty they had a wooden box made to put over top of the bottom part. It held three times as much sand as was required to ram up the box, so that the moulder had to lift three times as much sand as he would have done if he had been working on the floor, or with a hand-ramming machine. That machine was discarded. A turn-over machine was a decided success so far as making the bottoms, but when it came to the tops, which were practically all flat, the sand came down on the plate like a cone. They overcame that by putting two or three gaggers in the centre; then, if they did not use the vibrator until the box was just about to lift the pattern, and then gave it a few light taps with a mallet, which undoubtedly helped. The vibrator seemed to shake the inside of the box and not touch the outside. But, although they did well on the turn-over, a plate-moulder could do about twice as much on the floor. On sluice valves from 2 in. to 3 in., hand-ramming was quicker, on 4 in. they were about equal, on 5 in. and 6 in. the jolt rammer was the better. The boxes were 6 in. to 8 in. deep. It was necessary to get a good head of sand on and scrape it off again before the box could be turned round without sand dropping away from the sides. With little jobs they never had any success. He could quite understand Mr. Cook raising the question of the depth of the boxes, because in textile shops it was called a special box if it was 6 in. deep; more usually it was 3½ in. deep. For that about 8 in. head of sand was needed, and it entailed a lot of labour in throwing the sand as the machine stood about 2 ft. 6 in. from the floor. In loom sides the top parts only came 3 in. deep, and a jolt-ramming machine would never stand it, and one would have sand about three times the weight of the box. A loose-pattern moulder would make a larger quantity than the jar ram, with much less trouble.

In closing the discussion the CHAIRMAN said it was a most interesting topic, and many things had been said upon which the members could usefully reflect. Knowing the results which were got by plate-moulders in Lancashire, he thought it was a difficult ground to exploit in the interests of jar-ramming machines.

THE PARTNERSHIP heretofore subsisting between Messrs. W. Rawstron and J. Hayes, machinists and engineers, Victoria Works, Barlow Street, Rochdale, under the style of Rawstron & Hayes, has been dissolved.

Modernising the Cupola.

By "Egur."

The cupola is perhaps the most important part of a foundry's plant, and it is notorious that it should often be found the most antiquated The sample in one works with which the writer was associated was no exception to this rule. Of more immediate importance was the fact that it could not melt the iron quick enough for a casting weighing anything from four to seven tons. This weight was fairly often amongst our work, and it was always the case that overtime was a considerable item on the days when these castings were cast. It did not seem to matter how early the blast went on, there was always delay directly attributable to the cupola. The men had the best of excuses for hanging around, and nothing was done at such times but the consuming of tobacco.

This cupola was in design much like the other samples generally met with in small foundries making engineering castings. The casing was an old boiler or tube adapted to suit by cutting holes for the charging door, the tuyeres, tapping hole and the manhole at the bottom. It was about 4 ft. 6 in. inside dia., and the height to the charging door about 9 ft. Two tuyeres were arranged opposite each other about 2 ft. 9 in. from the bottom and were 4½ in. dia. They were parallel and directly connected to the blast pipe by means of a Y piece. Often the cupola tender wished to poke the tuyeres, and he did so through a small hole in the bend pipe, which directed the tuyere pipe downwards to the Y piece. The poking hole was closed in the usual backwoods style by means of a flat piece of scrap and some clay daubing. The lining inside the cupola tapered all the way down from the charging door to the tuyeres and finished at the foot on a solid brick bottom. Blast was delivered by a fan driven by a gas engine, and, as often happens, the pull on the belt was arranged the wrong way. An astonishing thing was that the fan was built as an exhausting fan, but being driven the opposite way it made quite a serviceable wind producer. For a charging platform a wooden scaffold had been erected, with a stair leading up to it. Up this stair all the coke and iron required for the heat had to be carried by hand. The reader will now have a general idea of the existing conditions, and by reference to Fig. 1 he will see at a glance what this cupola looked like.

To alter it we made out first of all a new design for the vital part, viz., the melting zone, and kept to measurements which allowed us to use the old cupola casing for the stack. Our ideas about cupola melting embraced as desirable the following points:—(a) Good height to charging door, (b) drop bottom, (c) wind belt having sectional area several times greater than blast pipe, (d) blast pipe to join wind belt at a tangent, (e) total tuyere area at outer end to be at least twice area of blast pipe, (f) total tuyere area at inner end to be five to six times area of outer end, (g) distance from tuyeres to bottom to be the lowest possible with safety, (h) outer ends of tuyeres to be fitted with doors, not necessarily air-tight, (k) opposite tuyeres on the wind belt, (l) doors to be fitted, which must be air-tight and to have glass circles fitted in the centres of the doors, (m) all joints in wind belt and pipe to be caulked air-tight.

A design governed by these conditions may seem formidable, as presenting a practical proposition to the unskilled ironfounder, but really there is nothing very difficult about it. The essential part was to get a proper job made of the malleable iron work composing the piece of the shell with the wind belt attached. This was of necessity given to an outside firm, whose trade happened to be the making of malleable iron tanks. We supplied a working drawing of our requirements and also a few practical directions from which they turned out a first-class job and at a very reasonable price. All the holes required were cut out at their proper places, with the result, that it was an easy job for an intelligent irondresser to fix on the fittings. The only other work done outside was the machining of the doors and flanges which fitted to the wind belt, opposite the tuyeres.

While the tank-makers were making their portion we were busy making patterns for the cast-iron work. Our handy man (a cartwright, by the way) made these quite satisfactorily to instructions and rough drawings. Our foreman moulder also assisted by making in the sand some pieces or portions without a pattern. A lot can be done in this way when the work is being made under one's own roof, and with considerable saving. For the pattern of the four legs required to support the cupola above the ground, a short round column pattern was adapted. Flanges for each end were made and fixed, the one as a base plate and the other to take the cast-iron ring on which the cupola rested. Four were cast off this, having the bolt holes cast in the flanges as required. The foundation ring was next made by sweeping up on a flat bed, and a segment pattern used to give the final finishing of the mould and to fix the bolt holes. The top side of the mould being flat, a plain top-part was all that was necessary. On to this ring the snugs were cast to form the hinges for the bottom doors, and cores were cast in for the hinge pins. Their respective positions were fixed by laying-off on the mould.

A half bottom-door pattern was made and two cast-off—one with a covering strip at the centre and the other plain. Cores were cast in here also for the hinge pins and for vent holes. Great accuracy in the placing of the cores for the hinge pins was essential, and to get them fair in line the core print was carried right across from hinge to hinge on the pattern, and a long straight core used. For the tuyere pipes a pattern was made of the shell type; it being exactly like a pipe, but having one side loose. In moulding them, the core was formed as part of the mould, and they were cast in greensand. Small dried cores were used to form bolt holes in the snugs for fixing the pipes to the cupola casing. In making the pattern for the doors at the outer ends of the tuyeres, the toothed quadrants presented a difficulty. It was satisfactorily met by adapting to our needs the rocker quadrants taken from a baby chair. These were made up as part of the patterns, and proved quite a useful idea. Then the doors and flanges to be fitted to the wind-belt were cast, and sent to the local engineer to be machined. A rough pattern was next made up for the tapping spout and two cast off it—one being cut in the sand to a shorter length for a slag spout. To finish our castings, we made a sill-piece for the charging door, and an arch plate, and were then ready with this portion of our work.

Being desirous of creating as little inconvenience as possible in the transformation of the old cupola to the new, we fixed on a different but convenient site. Concrete foundations were put in for the legs to rest on, their surfaces being kept about 6 in. below the ground level. Bolts were fixed in to hold down the leg castings at their positions, and when the concrete became thoroughly hard we started on erecting the structure. After setting up the legs we next put upon them the cast-iron ring forming the foundation plate, and bolted all securely together. The tank makers had by this time delivered their portion of the cupola, and we had also bought and erected a jib crane, to be afterwards used principally for lifting the coke and iron up to the charging scaffold. We used this crane therefore to set the new portion of the cupola upon the ring. Then we lifted the old cupola shell which had been stripped of its fittings and brick lining, and set it upon this new part. The two being bolted together, we next went along with the charging scaffold, which was raised to the new level required. The ground between and close around the foundation legs was excavated 6 in. deep and filled in solid with concrete. In the centre was placed a thick cast-iron plate on which the supporting prop for the doors rested. Meantime others were fitting the tuyere pipes in position, and when finished the building of the brick lining was started. Before this was finished all the other fittings were in place, and we were ready for the first heat. Instruc-

tions had to be given on the new type to the cupola tender. He had not worked a drop bottom before, and was not at all sure about it. Then the lining was carried up parallel all the way. To his mind this was not the proper shape, and besides he said the tuyeres were far too big. However, nothing would satisfy us but that he should work the new new cupola as we directed, and when he was dared to poke the tuyeres during a heat he thought someone had lost their senses. To do him justice, he did everything as required, and after the first heat he never had to be spoken to again. All went well from the very first, and our troubles regarding metal vanished. We could reckon on being all finished every night at 5 o'clock, and never had to pay overtime again because of the cupola. Notice might be taken of the doors fitted to the outer ends of the tuyeres, with respect to their usefulness. During a heat it frequently happens that one tuyere may be blowing "black cold." If the doors on this tuyere are closed for a time the heat from the surrounding coke inside penetrates outwards, and rekindles what had become black. Then the doors are opened, and the tuyere does its work as usual. These doors are also handy for shutting off the

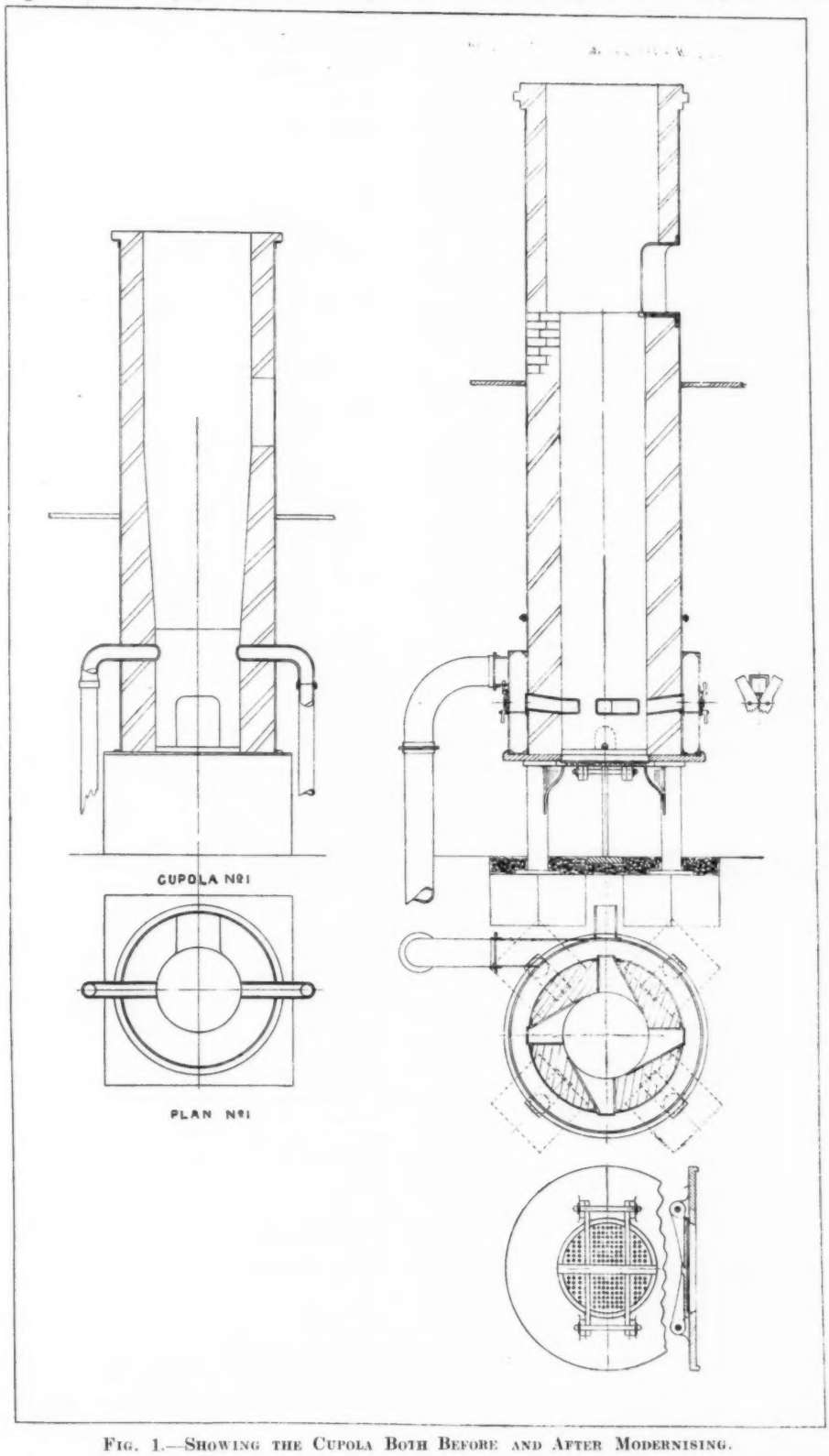

Fig. 1.—Showing the Cupola Both Before and After Modernising.

blast altogether from the cupola, should it be found necessary, without stopping the fan. The distance from the tuyeres to the bottom gave our cupola man grave concern. However, we kept a large ladle under the spout always, to take the metal as melted, and we did not believe in storing it inside the cupola.

A comparison between the two cupolas will show clearly the whole arrangement before and after alteration, and also the shape and style of the fittings we had to make. Both cupolas were the same size at the melting zone, but their capacity for melting was astonishingly different. It may be argued that the best was not got out of the old arrangement, but as the same tender worked both they had equal chances in this respect. When first he saw how he could watch the metal coming down by looking through the glass circles in the doors opposite the tuyeres, he was like a young boy with a new toy. And although at first he seemed to yearn to poke the tuyeres as of old, he very soon found the usefulness of the inside doors, and laid his poking bar aside as a quite unnecessary tool.

The Institute of Metals.

The annual general meeting of this Institute was held on Wednesday and Thursday at the House of the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1. The report of the Council on the work of the past year was presented by the President (Engineer Vice-Admiral Sir George Goodwin), and a report on the accounts by the Hon. Treasurer (Mr. A. E. Seaton). The results of the ballots for the Council for 1922 and for the election of new members was declared, after which the new President (Mr. Leonard Sumner) was inducted to the Chair, and delivered his inaugural address.

Report of Council.

According to the Report of the Council for 1921, notwithstanding the period of trade depression through which the world has been passing, the membership of the Institute has actually increased—from 1,298 on December 31, 1920, to 1,410 on December 31, 1921, on which date the number of members on the roll of the Institute was as follows: Honorary members, 3; ordinary members, 1,291; student members, 116. The financial position of the Institute as at June 30, 1921, was satisfactory, notwithstanding the great increases in expenditure, which had to be met by the increase in subscriptions.

After the new President had delivered his inaugural address, Mr. Bengough's report and a selection of Papers were presented and discussed.

NOTES ON THE CORROSION AND PROTECTION OF CONDENSER TUBES.

By G. D. Bengough, D.Sc. (Investigator to the Corrosion Research Committee).

These Notes dealt with ten years' scientific investigation of the problem on its practical side, and should be of considerable service to manufacturers of tubes for condenser plants, and to engineers who use them.

The following are summaries of some of the other papers:—

THE INTERNAL MECHANISM OF COLD-WORK AND RE-CRYSTALLISATION IN CUPRO-NICKEL.

By Frank Adcock.

Cast cupro-nickel, annealed until homogeneous, was selected as a suitable basic material since good etchings were obtainable with citric acid (electrolytic). The metal was able to withstand a considerable amount of cold working, and yet was sufficiently hard to permit of rapid preparation for examination. Material which had been subjected to reductions of 50 per cent. and 88 per cent. by cold working was examined, and observations were made on the nature and direction of certain strain planes which passed through most of the crystal grains of the distorted metal. The possibility of a gradual distortion of the crystal structure, apart from "slip," was also dealt with, and reference was also made to the cavities which appeared on etching the worked material.

In order to follow the process of recrystallisation, cold-worked specimens which had been annealed for fixed periods of time at progressively higher temperatures were examined microscopically. It was noticed that the first effect of annealing was the accentuation of the "strain" markings previously visible in the worked specimens, followed at higher annealing temperatures by the appearance of new crystal grains, which were generally associated with the previously-mentioned "strain" markings and occasionally with old crystal grain boundaries. New grains which appeared on the sites of the "strain" lines were frequently elongated in the direction of these lines, but not necessarily in the direction of rolling, and, further, the crystalline orientations of such grains were apparently not related to that of the old grain in which they were born.

A theory was put forward as an attempt to explain some of the experimental facts which were not altogether in agreement with the usually accepted views on the subject. The Brinell hardness of the cold-worked metal did not begin to fall appreciably until the annealing temperature was such that new crystal grains were readily discernible under the microscope.

SOME CASES OF "FAILURE IN ALUMINIUM" ALLOYS.

By W. Rosenhain, D.Sc.

The Note dealt with cases of failure from growth or distortion occurring in so-called "aluminium alloys." The author found that the alloys which underwent distortion and disintegration of this kind usually consisted mainly of zinc, and were not properly described as aluminium alloys, the latter term being rightly reserved for materials consisting mainly of aluminium. Two cases were described in detail, one relating to an electricity meter casing which contained 81 per cent. of zinc, and the other to a name-plate which contained 54 per cent. of zinc. In both cases distortion, growth, and disintegration had occurred. It had been shown in a previous Paper by the author (with Messrs. Haughton and Bingham) that alloys consisting largely of zinc and also containing aluminium and copper were unstable at the ordinary temperatures and liable to changes of size and disintegration. The failure of castings of the kind described was, therefore, not surprising. Careful distinction should, however, be made between alloys of this kind consisting largely of zinc and true light alloys of aluminium. The latter, if properly compounded and prepared, could be regarded as sound materials of engineering free from any risk of serious growth or disintegration, and it would be unfortunate if their use were in any way hampered by unfavourable experiences with alloys containing a large amount of zinc.

FURTHER STUDY OF THE ALLOYS OF ALUMINIUM AND ZINC.

By D. Hanson, D.Sc., and Marie L. V. Gayler.

The present work was undertaken with a view to investigating further the constitution of the phase known as "delta" in the diagram of Rosenhain and Archbutt. Preliminary experiments with alloys containing 70, 60, 50 per cent. of zinc when slowly cooled to 284 deg. C., after prolonged annealing at 420 deg. C. and quenched, were found to be duplex in structure. The inconsistencies between these microstructures and those suggested by the existing diagrams led to a redetermination of the solidus from 81 per cent. zinc to 20 per cent. zinc. The results obtained differed appreciably from those of previous workers; the line representing the peritectic reaction was found to extend up to a composition of 70 per cent. zinc as against 40 per cent. zinc in previous diagrams.

THE RATE OF COMBINATION OF COPPER AND PHOSPHORUS AT VARIOUS TEMPERATURES.

By Professor C. A. Edwards, D.Sc., and A. J. Murphy.

The object of the research was to determine the temperature at which rapid combination between copper and phosphorus commenced, and to trace the effect of time on the progress of the reaction velocity. The rate at which solid copper combined with phosphorus vapour at temperatures up to 700 deg. C. had been determined. When using a ½-in. diameter copper rod it was found that the maximum rate of increase of phosphorisation for a given rise of temperature was at 640 deg. C. It ought to be an easy matter to evolve a continuous process which would be free from danger and give little or no loss of phosphorus.

Annual Dinner.

The annual dinner of the Institute was held on Wednesday evening at the Trocadero Restaurant, and on Thursday afternoon a visit was paid to the Royal School of Mines at South Kensington.

Trade Talk.

THE SEATON CAREW IRON COMPANY, LIMITED, restarted one of their blast furnaces last week.

THE Peterborough engineering works of Baker, Son, & Perkins have been seriously damaged by fire.

HANSON & EDWARDS, LIMITED, Vernon Street Works, Warrington, are making extensions to their foundry.

Two furnaces were put into blast at the United Steel Companies' Derwent Works, at Workington, on March 7.

IN THE SHEFFIELD AREA it is proposed to reduce the wages of patternmakers 26s. 6d. per week, making the wage 51s. for 47 hours.

THOS. FIRTH & SONS, LIMITED, have transferred their publicity department from 8, The Sanctuary, London, S.W.1, to the works in Sheffield.

MR. J. GREVENER, iron and metal merchant, formerly of 77, Gamage Building, Holborn, has removed to 49, Queen Victoria Street, London, E.C.4.

MR. H. C. DOBSON, 109, Pitt Street, Sydney, has been appointed Australian agent for the Sheffield & Hallamshire Hacksaw Company, Limited, Sheffield.

BETWEEN 500 and 600 riveters in Leith shipyards came out on strike recently as the result of a dispute which had arisen over a question of management.

A DISCOVERY of manganese ore has been made in Strathnairn, about six miles from Inverness and close to Culloden Moor Station, on the Inverness and Aviemore Railway.

THE TEES-SIDE BRIDGE AND ENGINEERING WORKS, LIMITED, are establishing a new foundry at North Ormesby, the plans for which have been approved by the Middlesbrough Corporation.

THE men connected with the Wear Federation of Shipbuilding Trades have agreed to accept the employers' proposal to adopt the hourly in place of the daily system of working and payment.

THE IMPORTS of foreign iron ore at the Senhouse dock, Maryport, during February, amounted to 4,100 tons, compared with 5,200 tons for January, and 3,000 tons at the corresponding period of last year.

THE TENTH ANNUAL DINNER of the staff of Ferranti, Limited, was held on Friday, March 3, at the Midland Hotel, Manchester, and was followed by a dance. The chairman of the company, Mr. A. W. Tait, received the guests and presided over the dinner.

WE understand that the notice which was given in last week's issue of the Journal respecting the removal of Messrs. J. A. Prestwick & Company, Limited, of Northumberland Park, Tottenham, London, N.17, is incorrect. They have no intention of removing.

AT a meeting of the executive committee of the Royal Metal Trades Pension Society, held on Monday, March 6, Mr. John Scott Balfour, J.P., and Mr. Alexander K. Steven were re-elected chairman and vice-chairman respectively for the ensuing year.

THE Wear shipbuilding output for the past two months is better than it was for the corresponding period of 1921. Seven vessels have left their berths with an aggregate gross tonnage of 34,585 compared with six and 25 210 gross tons in the first two months of 1921.

SOME 10,000 members of the Amalgamated Society of Railway Vehicle Builders, Wheelwrights, Carpenters, and Mechanics are on strike against wage reductions, which, it is stated, would represent a fall of £2 0s. 9d. per week per man for piece-work and £1 13s. for time-work.

THE Belfast Harbour Commissioners have constructed a timber wharf, 250 ft. long, for the handling of steel and iron, in the Musgrove Channel, immediately adjacent to Messrs. Harland & Wolff's new yard, and a ferro-concrete wharf on the river proper for the same purpose.

THE WELLMAN SMITH OWEN ENGINEERING CORPORATION, LIMITED, of London and Darlaston, are supplying the Steel Company of Scotland (Limited), of Glasgow, with gas-producer plant consisting of seven Wellman mechanical producers, complete with bunkers, mechanical feeds, gas mains, etc.

AT a recent meeting of the North-East Coast Institution of Engineers and Shipbuilders Mr. Paul Belyavin lectured at Newcastle-on-Tyne on some problems of the marine Diesel engine design. Mr. Belyavin is on the technical staff of Messrs. Swan, Hunter & Wigham Richardson, Limited, Neptune Works, Walker, having previously held the appointment of manager and chief designer of the Russian Admiralty's Baltic shipbuilding and engineering works at Petrograd, where he had excellent opportunities of studying the design of the chief European Diesel engines.

THE fire which recently occurred at the premises of Messrs. Baker, Sons, & Perkins, Limited, at Peterborough, was not so serious as at first reported. The conflagration destroyed the general store and small-tool department of the machine shops, but the firm state that other parts of the works were not seriously damaged, and will, it is expected, soon be in operation again.

THE ASCERTAINED PRICE of West Coast mixed numbers of hematite pig-iron for the month of February was £5 2s. 1d. per ton, a reduction in price compared with the previous month of 3s. 8d. per ton. The sliding scale percentage on base rates, 5s. and over, will be 40 per cent., a reduction of 4½ per cent. Blastfurnacemen's wages will now stand at 77½ per cent. above standard.

AT a sitting of the Railway Rates Advisory Committee, it was stated that the railway companies are receiving correspondence which indicates that many traders are under the impression that the new classification comes into force immediately. Under the Railways Act of 1921 the final new classification will operate "from a date to be appointed." It will probably be from two to three years hence.

TO replace the floating crane Titan, which was sunk in the Tyne during a gale, on December 17, Messrs. Swan, Hunter & Wigham Richardson, Limited, of Wallsend, have purchased an improved type of crane with a similar lifting capacity of 150 tons from a Dutch firm, and it is expected that the crane will arrive in the Tyne in a week or two weeks' time. A crane was urgently needed, and that purchased was ready for delivery.

THE BROKEN HILL PROPRIETARY COMPANY, LIMITED, announce that the present steel orders at the Newcastle (N.S.W.) works will be completed in four or five weeks, after which the works will be closed down. He states that the company are unable to manufacture and sell merchant bars at the price at which the company are selling, viz., £16 10s. per ton, and that they are furthermore unable to secure orders even at that quotation because imported bars are selling at £14 14s. per ton.

EDGAR ALLEN & COMPANY, LIMITED, Imperial Steel Works, Sheffield, are financially and technically interested in Industrial Steels, Limited, which was formed to take over the Stevenson Road Works of Jonas & Colver, Limited. This plant consists of the Siemens department, together with the rolling mills, forge, etc. By this arrangement Edgar Allen & Company, Limited, are now in a position to supply Siemens-Martin steel ingots, slabs and billets of any size, bars up to 10 in. dia., steel forgings up to 10 tons in weight, etc.

THE production of pig-iron in February amounted to 300,100 tons, a figure higher than has been reached in any month since the coal stoppage began, but less by 163,500 tons than the production of the corresponding month last year. The furnaces in blast at the end of February numbered 101 compared with 90 at the end of January and 193 at the end of February, 1920. Of the production of pig-iron in February 101,800 tons were hematite, 90,100 tons basic, 69,000 tons foundry and 20,000 tons forge. The production of steel ingots and castings in February amounted to 415,000 tons compared with 327,500 tons in January and 483,500 tons in February, 1921.

SIR WM. J. NOBLE, BART., presided over the annual dinner of the North-East Coast Institution of Engineers and Shipbuilders, at Newcastle, on March 3. There was a large and distinguished gathering, including the Lord Mayor of Newcastle (Mr. R. H. Millison), Sir Frederick Lewis, Bart., Chairman of the Chamber of Shipping; Mr. A. E. Rucke Keene, Lloyd's Register; Sir Alex. Kennedy, Sir Archibald Ross, Sir Theodore Morison, Armstrong College; Mr. T. Russel Bairns, chairman of the North of England Steamship Owners' Association; Major Sir R. A. Kerr Montgomery, Sir George Renwick, Mr. H. Yarrow, Institution of Engineers and Shipbuilders in Scotland, and Mr. E. Archer Coulson, president of the Cleveland Institution of Engineers.

RETURNS were submitted at a meeting of the Tees Conservancy Commission, showing the iron and steel imported to the Tees ports from Holland, Belgium, France, Norway, Sweden, Germany, and coastwise (Wales) for the four months ending February 28, 1922, as compared with the corresponding periods of 1913-14 and 1920-21. Pig-iron imported in the past four months reached 28,045 tons, against 7,375 tons for the same time twelve months ago, and 54 tons in the corresponding pre-war period of 1913-14. Billets, blooms, and slabs brought from the countries named totalled during the past four months 17,948 tons, against 12,571 tons in 1920-21, and 14,309 tons in 1913-14. Only 2,340 tons of plates, bars, angles, rails, sheets, and joists arrived in the Tees in the past four months from the countries named, as compared with 9,482 tons in the corresponding period of 1920-21, and 7,906 tons in 1913-14.

XUM

IRON AND STEEL MARKETS.

Pig-iron.

Movements in the pig-iron markets fairly maintained their previous active conditions during the past week, but have since experienced a somewhat serious setback when it became known that negotiations for the settlement of the engineers' difficulty had failed and that the threatened lock-out had been carried into effect. The result has been to check the home consumptive demand for the time being, to which of late the engineering industry as a whole has been the chief support, pig-iron being, of course, the basic raw material employed in all branches of the trade. In the Midlands, for some time past, smelters have found difficulty in disposing of the limited output of forge and foundry iron, the bulk of the business done being in the latter quality, Derbyshire No. 3 making up to 82s. 6d. and similar brands of Northamptonshire 80s. From the West of Scotland area comes the interesting announcement that members of the Glasgow Iron Ring have decided to resume operations on the 15th inst., meetings to be held for the present on Wednesdays only. It is not, however, considered likely that there will be any business in warrants for some time, as stocks in warehouses must necessarily be slow in accumulating while the rate of output continues short. In the Cleveland market the improvement in the home and export demand has, so far, been well maintained and has fully absorbed the furnace output. Expansion of production, however, has been checked by the unexpected advance in the price of coke, which has made the manufacture of pig-iron more than ever unremunerative. Notwithstanding these adverse conditions makers have made no change in current prices, which rule as follow: No. 1, 95s.; No. 3 G.M.B., 90s.; No. 4 foundry, 87s. 6d.; No. 4 forge, 82s. 6d. Mottled and white are freely negotiable at round about 75s.

East Coast hematite continues very strong, export inquiry being well maintained, and there is an improvement in business with South Wales. There is very little prompt iron available, and this makes fully 100s. per ton for mixed numbers, with a premium of 1s. for No. 1. In West Cumberland, also, business is distinctly brisker, export trade being on an increasing scale, with prices firmly maintained at 98s. 6d. per ton at works for Bessemer mixed numbers.

Finished Iron.

Makers of finished material in South Staffordshire report little improvement in the general conditions of the trade, new orders coming forward very sparely, and except for marked bars, most of the works being entirely or partially idle. On the Birmingham Exchange last week, although there was a full attendance, fears of forthcoming labour troubles had a paralysing effect upon demand, the threatened dislocation of the great engineering industry, even for a few weeks, having a depressing effect upon market business all round. Buying, as far as finished iron was concerned, was consequently at a standstill, and until confidence is again restored, business is likely to continue on the present restricted scale. Most of the marked-bar houses, however, have a moderate volume of specifications on hand sufficient to keep mills working for a time, but several well-known makers of crown and ordinary varieties are either idle altogether or running with unprofitable results. In the Lancashire market for finished material, there is no change so far as the local prices are concerned, but the demand here is declining, as a result of the fear that engineering and shipbuilding will cease altogether for a time. The export demand for finished material is said to be fairly good, but it is not profitable, and is only of service as a means of keeping works going, which would otherwise have to shut down altogether.

Steel.

Conditions in the steel trade at Sheffield are much the same as those prevailing for the past few weeks, and, with the stoppage of engineering works, the prospect can hardly be described as promising any early return to normal activity. The fresh crisis in the labour position has, unfortunately, happened at a time when hopes of revived trade were fully justified by circumstances, and, following closely the cancellation of important Admiralty contracts, must inevitably have a prejudicial effect upon the future development of the steel and allied industries. As far as actual business is concerned for the present, steel makers are still awaiting the issue of orders for material by the railway companies, which must by this time be in pressing need of renewals of permanent way and rolling stock requirements, but so far as can be ascertained very few specifications have yet been circulated or tenders invited in this connection. The outlook in the export trade shows a slight improvement, some fair-sized orders having been placed from the Far East, while Australia is also a buyer on a moderate scale, and some recovery is being made in South American markets. A fair quantity of billets is selling, but supplies are well above demand. Prices: Basic, soft, £7 5s. to £7 10s.; medium, £8 15s.; hard, £9 5s. Acid: Bessemer, £12 10s.; Siemens, £10 to £11. There is said to be a little better market for mild steel. High-speed steel is stagnant, and doubts of any early recovery are expressed. The production of steel ingots and castings in February amounted to 415,000 tons, compared with 327,500 tons in January and 483,500 tons in February, 1921.

Scrap.

Though generally quiet, the scrap trade in the Midlands shows at last some sign of improvement, the demand for steel material especially indicating more activity than of late, with prices firm at recent quotations, heavy qualities making from 50s. to 55s. per ton. Good selected piling iron realises 75s., with cast-iron borings at 30s. and heavy steel turnings at 35s., f.o.r. Heavy cast-iron scrap is quoted 75s. to 80s., and light qualities 60s. per ton.

Tinplates.

There has been little change in the position of the tinplate trade since last reported, only a limited home and export demand claiming the attention of merchants and makers, who, however, hold firmly to current quotations, with very few sales recorded beyond April deliveries. I.C. 14 by 20, 112 sheets, in coke finish, are quoted at about 18s. 9d. to 19s. per box for spot lots, with 28 by 20 sizes, 112 sheets, 216 lbs. March delivery, realising 37s. 6d. to 37s. 9d., ex-stock. In the waster section light weights are in demand for the Far East, but are scarce, with current quotations ruling C.W. 14 by 20, 108 lbs., 17s. to 17s. 3d.; 28 by 20, 216 lbs., 33s. 9d. to 34s.; and 20 to 10, 156 lbs., 22s. 3d. to 22s. 6d. per box; all f.o.b. net cash, South Wales.

Metals.

Copper.—Notwithstanding the unfavourable labour outlook in the consuming industries, the week's markets for standard copper opened with a fairly confident tone, some heavy purchases for cash resulting in a moderate advance in that position, with a similar movement on forward account. A recent noteworthy feature in market movements has been a little better demand for home consumers, while, on the whole, the speculative element has been less aggressive. March dates were done at £60 15s. to £60 10s., April £60 12s. 6d. to £60 15s., with refined copper steady and unchanged. Closing prices:—Cash: Wednesday, £61 2s. 6d.; Thursday, £60 7s. 6d.; Friday, £60 5s.; Monday, £60 10s.; Tuesday, £60 12s. 6d. Three months: Wednesday, £62 2s. 6d.; Thursday, £61 7s. 6d.; Friday, £61 2s. 6d.; Monday, £61 10s.; Tuesday, £61 12s. 6d.

Tin.—Following the recent weakness in the foreign tin market, the position last week underwent a slight improvement, resulting from a better trade demand and more favourable advices from America, where a somewhat stronger buying movement has been in progress. Movements in Monday's opening market, however, took a less favourable turn, offerings being heavy and under extreme selling pressure further weakness developed. March deliveries were sold at £143 5s. to £142 15s., closing £143: April, £143 10s.; May, £144, with Banca, March delivery, selling at £143 5s. English ingots also closed rather lower at £143. The weekly return of London tin stocks showed 4,582 tons, a decrease of 105 tons; Liverpool, 758 tons, a decrease of 1,703 tons. Closing prices:—Cash: Wednesday, £142 15s.; Thursday, £142; Friday, £145; Monday, £143; Tuesday, £142 15s. Three months: Wednesday, £144 15s.; Thursday, £144; Friday, £147; Monday, £144 17s. 6d.; Tuesday, £144 10s.

Spelter.—The market for this metal opened quietly, but a fair measure of support was forthcoming, and prices responded, both prompt and forward deliveries marking an advance of 2s. 6d. per ton. Closing prices:—Ordinary brands: Wednesday, £26 2s. 6d.; Thursday, £25 17s. 6d.; Friday, £25 17s. 6d.; Monday, £26; Tuesday, £25 15s.

Lead.—There was a steady demand for soft foreign pig in this week's opening market, and a small advance was recorded for both near and future dates. Prices were again firmly held for English, with quotations as follow: Wednesday, £22 5s.; Thursday, £22 5s.; Friday, £22 5s.; Monday, £22 5s.; Tuesday, £22 10s.

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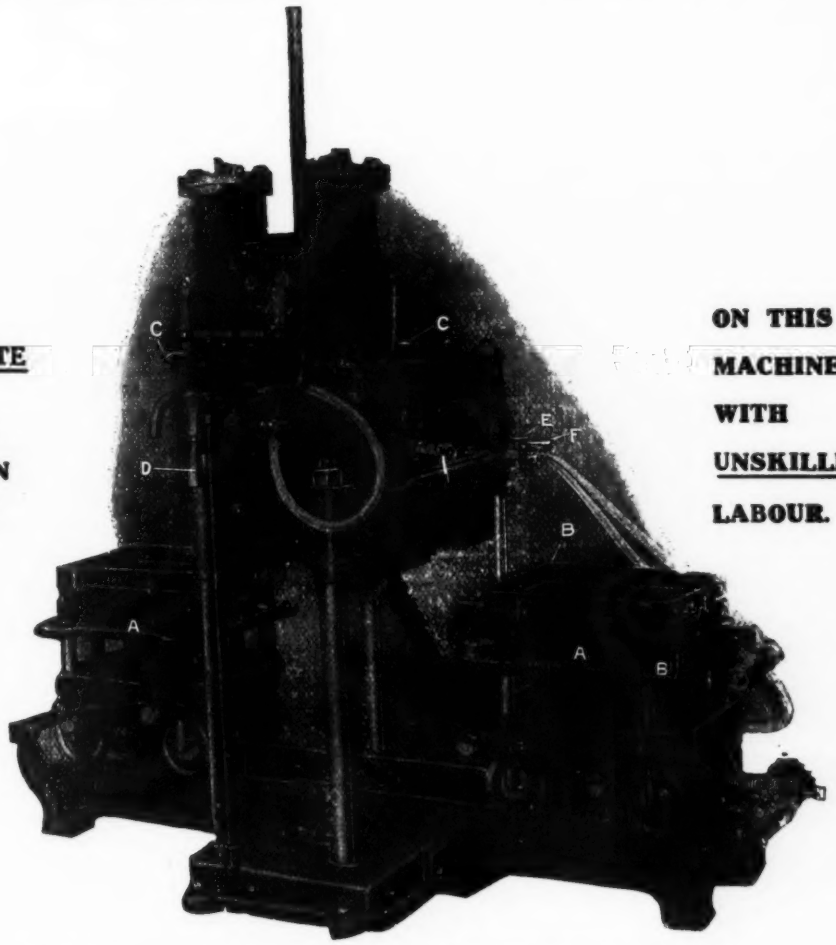

ON THIS MACHINE WITH UNSKILLED LABOUR.

One of many that we have installed in various Munition Work Centres.

JAMES EVANS & CO., BRITANNIA WORKS, BLACKFRIARS, MANCHESTER.

Foundry Queries.

Manufacture of Railway Chairs.

In reply to your correspondent's inquiry as to the manufacture of cast-iron railway chairs, the following brief facts may prove of interest. The problem is essentially one of large production, the processes are very definite, but quite straightforward, and, where the best methods are adopted, quite good profits may be secured in spite of the competition which now exists for this class of work. The present-day selling price is so low that large outputs are essential to secure a satisfactory margin of profit.

Metal patterns are used, mounted with stripping plates on hand ram, jolting, or pressure machines. The former machines predominate, the latter are seen in the best practice. Two men, unskilled, operate each drag machine, and two lads operate each cope machine. Sand falls from a hopper straight into the moulding boxes as they lie on the machine table. After ramming, the patterns are drawn—the green-sand cores are formed in position and require no attention, the drag is lifted, turned over, and placed either on a conveyer or a bogie; a loose piece picked out of the mould and returned to its place on the pattern. Finally the cope is placed in position over the drag.

Casting is practically continuous where a battery of moulding machines is installed. The moulds are conveyed close up to the cupola, where they are poured direct from a receiver, and then passed on over a grating towards the loading trucks. Whilst still hot the castings are knocked out—the sand, when in proper condition, is practically self cleaning, and falls away through the grating. Any slight fin may be easily knocked off the casting, which is finally dropped into the railway truck for despatch. The box parts are taken back to the moulding machines, whilst the sand, falling into a hopper, is elevated, riddled, mixed and tempered, and returned to the sand hoppers over the moulding machines.

An output of at least five chair castings should be secured each minute from one cope machine and two drag machines.

Cupola practice must be good; a cheap semi-steel mixture appears to be best; discard is practically negligible; supervision must be exceedingly keen and active to get the plant into running order; the moulding boxes must be made to suit the job, and patterns and stripping plates must be practically perfect.

I shall be pleased to supply your correspondent with details and actual cost of plant, piece prices, estimated overhead and material costs, etc., should they be required. Ogre.

Piston Ring Casting.

22d.—Bushes for piston rings, although quite plain and very easily moulded, sometimes give a lot of trouble. Of course, the metal in piston rings should always be a little softer than that in the cylinder. It is much easier to replace the rings than to re-bore the cylinder. There are many brands of pig-iron which give satisfactory results, but I think a trial could be given with the pig-iron you have in the following proportions:—

	Cwt.	qr.	lbs.
Pig	1	2	0
Scrap	3	1	0
Steel		1	0

Either of the brands of pig which you have, together with good machinery scrap and mild steel scrap. It is essential that the metal be very hot, well mixed, and cast very clean, using a plug or strainer runner. The casting should be poured at the top.—J. E.

Mr. J. O. Whitehouse, edge tool manufacturer, Cannock; Mr. J. E. Brittain, engineer, Chesterton; Mr. C. Lathe, ironfounder, Tipton; Mr. J. Thompson, engineer, Coseley; Mr. W. W. Doughty, ironfounder, Tipton; Mr. T. E. Salter, ironfounder, Tipton; Mr. J. E. Shaw, iron merchant, Old Hill; Mr. W. A. Robbins, foundry manager, Tipton; Mr. A. Hassam, mining engineer, Newcastle, Staffs.; and Mr. R. R. Plant, colliery official, Burntwood, have been returned unopposed as members of the Staffordshire County Council.

Company News.

Stothert & Pitt, Limited.—Interim dividend, 1s. per share, free of tax.

Bolckow, Vaughan & Company, Limited.—No interim dividend on ordinary shares.

United Steel Companies, Limited.—Preference dividend for past half-year, 6 per cent. per annum.

Scottish Iron & Steel Company, Limited.—Ordinary dividend, 6 per cent., less tax, for year.

Neptune Foundry Company, Limited.—Capital £2,500 in £1 shares. Directors: L. S. Beyts and T. Parkinson.

"Tarpers," Limited.—Capital £1,500. Ironfounders, mechanical engineers, etc. Directors: E. H. Williams, J. B. Torr and T. S. Grout.

Henderson, Clifton & Company, Limited.—Capital £1,500 in £1 shares. Engineers. Directors: A. J. Henderson and Major E. H. Clifton. Registered office: 35, Sackville Street, W.1.

John Hesford & Company, Limited.—Capital £1,000 in £1 shares. Engineers. Directors: J. H. Evans and J. Halliwell. Registered office: 31, Dutton Street, Strangeways, Manchester.

Roe, Upton & Company, Limited.—Capital £1,000. Mechanical engineers, founders, etc. Permanent directors: J. P. Bland, T. H. Fishburn, E. J. T. Roe (secretary), and G. H. Hodge. Registered office: 47, Victoria Street, S.W.1.

Southall Engineering Company, Limited. — Capital £3,000 in £1 shares. Directors: A. Bailey, J. C. Weber and R. Carter. Registered office: Pioneer Works, Hammond Road, Southall.

Thomas L. Hale (Tipton), Limited.—Capital £25,000 in £1 shares. Steel founders. Registered office: Dudley Port, Tipton, Staffs.

C. and H. Gasson, Limited.—Capital £5,000 in £1 shares (2,000 preference). Engineers. Directors: C. E. Gasson (permanent managing director and chairman), H. C. Gasson, P. G. Gasson, and A. E. Gasson (secretary). Registered office: 155, London Road, East Grinstead, Sussex.

Gazette.

Mr. G. F. Rogers, Metog Foundry, High Street, Tipton, is paying a first and final dividend of 1s. 2¾d. in the £.

Messrs. H. Ellis and J. Turner iron and brass founders, 106a, Derby Road, Bootle, trading under the style of Ellis & Turner, have dissolved partnership.

A receiving order has been made in connection with the affairs of Messrs. A. T. Williams and W. J. Bevan, trading as the Electrical and General Engineering Company, 49, Commercial Street, Aberdare.

Messrs. A. S. Russell and H. F. Moore, electrical engineers, Shafton Lane, Holbeck, Leeds, trading under the style of Firth & Russell, have dissolved partnership. Mr. H. F. Moore will continue the business.

Catalogues Received.

Messrs. Francis Morton & Company, Limited, bridge and roof builders, constructional engineers, ironfounders, etc., Hamilton Iron Works, Garston, Liverpool, forward a recent issue of "Iron Castings," fully illustrated, with descriptive particulars of heavy iron castings, which form a speciality of the firm's productions.

Electro-Metals, Limited, 56, Kingsway, London, W.C.2, "Electric Steel Furnaces," reviewing the developments in the application of electrically-produced heat to the melting and refining processes in that branch of metallurgical science. The subject is treated in a comprehensive manner, with numerous illustrations of the latest types of electrical furnace and improvements in design and construction.

Messrs. G. W. Wilkinson & Sons, Limited, Workington, writing pad and calendar for 1922.

Messrs. G. B. Stephen & Company, Limited, Smethwick, foundry fuels merchants. Pull-off calendar.

Messrs. R. J. & M. Carr, Limited, Bradford. Calendar.

Messrs. The International Construction Company, Limited, 56, Kingsway, London, W.C.2. Calendar.

Mr. E. Walker, who died recently in his eighty-first year, was the founder of E. Walker & Company, makers of water pipes, lead and copper pipe coils, etc., High Street, Heckmondwike. The deceased gentleman carried out extensive experiments with non-poisonous pipes.